COMPARISON OF RECTAL AND AXILLARY TEMPERATURES OF ISA BROWN AND HARCO BLACK LAYERS FED DIFFERENT LEVELS OF DIETARY ACETYLSALICYLIC ACID

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ABSTRACT

This experiment was performed to compare the axillary and rectal temperature of two breeds of commercial layers: Harco Black (HB) and Isa Brown (IB) in their early stage of production. Four diets with different acetyl salicylic acid (ASA) levels of 0.00 % - the control diet (T1), 0.025 % (T2), 0.050 % (T3) and 0.075 % (T4) were fed to the birds throughout the eight weeks of the study. The result showed that the ambient temperatures were well above the birds' thermo-neutral zone in the mornings (25.50°C), afternoons (31.75°C) and evenings (30.08°C) throughout the duration of the experiment. There were no breed differences (p>0.05) in the axillary temperature measured either in the mornings (MAXT), afternoons (AAXT) or evenings (EAXT) but the morning (MRT), afternoon (ART) and evening rectal temperature (ERT) differed between the HB and IB breed. ERT and EAXT were significantly different (p<0.05) among treatments. Layers fed dietary inclusion of 0.075 % ASA had the lowest ERT (41.54°C) and those fed the control diet had the highest ERT (41.72°C) and evening EAXT (40.85°C). The administration of ASA reduced the EAXT by 0.26°C and ERT by 0.18°C. Also, there was a decrease in the rectal temperature as the level of ASA in the diets increased. In conclusion, 0.075 % of ASA in layers diets could ameliorate the ill effects of heat stress on laying chickens through its anti-pyretic effects. Comparatively, the rectal temperature proved to be the more sensitive method of determining the core body temperature which fluctuates in consonance with the ambient temperature. Also, the Isa Brown breed could tolerate more heat stress than the Harco Black.

Keywords: Ambient temperature, Heat stress, Harco Black, Isa Brown, Layers, Rectal temperature

INTRODUCTION

High ambient temperature especially in hot climates can impact negatively on the health and performance of domestic animals (Ajakaiye *et al*., 2011). It is also implicated in reduced reproductive performance, disruption of hormonal balance and reduced feed intake in laying chickens (Franco-Jimenez *et al*., 2007). Given that the thermo-neutral zone of laying birds ranges between 18 and 24°C (Holik, 2009), maintaining thermo-balance between their internal external milieu is always a challenge to birds raised in tropical climates. This condition is usually worsened when coupled with an equally high relative humidity (Simon, 2003) with a concomitant reduction in evapo-transpiration. Several measures at relieving heat-stressed animals have been reported in the literature like the use of ascorbic acid (Khan and Sardar, 2005), acetyl salicylic acid (Amao and Siyanbola, 2012), good ventilation and provision of cool drinking water (Oluyemi and Roberts, 1979) and administration of potassium chloride (Ahmad *et al*., 2008).

Acetyl salicylic acid (ASA) is a well-known antipyretic drug (Jack, 1997). It has been demonstrated that feeding ASA to chickens during heat stress lowers body temperature. McDaniel and Parker (2004) reported that feeding 0.05 % ASA to broilers decreased body temperature by as much as 0.3°C when birds were exposed to an ambient temperature of 29°C. Amao and Siyanbola (2012) reported that feeding layers with 0.05 % ASA favoured shell thickness, while 0.10 % ASA increased hen-day production. Also, Al-Obaidi and Al-Shadeedi (2010) reported that feeding of 0.2 % ASA to broilers increased live body weight.

Commercial laying birds are one of the farm animals that are mostly exposed to the exigencies of environmental variables like humidity, draught, solar radiation and high ambient temperature. Most commercial laying birds are often kept for more than 72 weeks in lay before being disposed off as spent layers during which time they are kept under the direct assault of these environmental variables. The loss in production, efficiency and physiological conditions of livestock under such inclement environment is better imagined than experienced.

There is dearth of information on the relative tolerance of our commercial layers' breeds to heat stress especially under the ameliorative effect of dietary supplementation of ASA. Also, the relative sensitivity of the conventional methods of measuring body temperature of farm animals using the rectal, axillary and oral routes have not been compared in the commercial layers fed dietary inclusion of ASA. Therefore this study sought to compare the rectal and axillary temperature of Isa Brown and Harco Black breeds of commercial layers with a view to determining their relative tolerance to heat stress under the antipyretic effect of graded levels of dietary ASA.

MATERIALS AND METHODS

Experimental Site: The experiment was carried out at the Livestock Section of Teaching and Research Farm of the Federal University of Technology, Akure, Ondo State, Nigeria. Akure is located on latitude 7°18′N and longitude 5°10′E. The site is within the hot, wet equatorial climate with high rainfall (1,500 mm) relative humidity (well above 75 %) all the year round with an annual temperature of about 27°C.

Effect of Acetyl Salicylic Acid on Laying Birds: Two hundred point-of-lay birds were purchased from a reliable source comprising 100 Harco Black and 100 Isa Brown breeds respectively. The experiment was a completely randomized design with four experimental diets formulated to meet the nutrient requirement of layers in which acetyl salicylic acid (ASA), was added at 0.00, 0.025, 0.050 and 0.075 % of the diets respectively. The 0.00 % diet (T1) served as the control while the other three diets were assigned T2, T3 and T4 respectively. Each treatment consisted of four replicates in which the two breeds of birds were used at 12 birds per replicate and 48 birds per treatment. The experiment was carried out over a period of 8 weeks. The hens were fed with the experimental diets according to their respective treatments until the end of the experiment. The gross composition of the experimental diets is presented in Table 1. Medications and vaccinations were administered as at when due and spent litter materials were removed every week. The birds were fed *ad libitum* for 12 hours daylight period.

Data Collection and Analysis: The ambient temperature was taken with a mercury-in-glass thermometer, while rectal temperature and the axillary temperatures were taken with a digital thermometer model KD-2201 (K-Jump Health Company, Limited). All these parameters were measured three times weekly at 6 am, 12 noon and 6 pm for eight weeks. Data collected were subjected to two way analysis of variance using SAS (2003) version 9.2. Significant means were separated using Duncan multiple range test (DMRT) (Ducan, 1955).

RESULTS AND DISCUSSION

The average ambient, rectal and axillary temperature of Harco Black and Isa Brown layers fed varying levels of ASA indicated that the morning (MRT), afternoon (ART) and evening (ERT) rectal temperatures were significantly different between the two breeds of layers (Table 2).

Table 1: Gross composition of experimental diets supplemented with different levels of acetylsalicylic acid fed to Isa Brown and Harco Black layers

Ingredients	T1	T2	T3	T4
Maize	50.00	50.00	50.00	50.00
Groundnut cake	6.50	6.50	6.50	6.50
Soybean meal	12.00	12.00	12.00	12.00
Palm kernel cake	3.50	3.50	3.50	3.50
Wheat offal	17	16.98	16.95	16.93
Fish meal	1.00	1.00	1.00	1.00
Bone meal	2.60	2.60	2.60	2.60
Limestone	6.50	6.50	6.50	6.50
Methionine	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10
Layers' Premix	0.25	0.25	0.25	0.25
Salt	0.30	0.30	0.30	0.30
ASA	0.00	0.025	0.050	0.075
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated content				
Crude protein	16.70	16.70	16.70	16.70
ME (Kcal/kg)	2508	2508	2508	2508
Crude fibre	4.48	4.48	4.48	4.48
Calcium	3.32	3.32	3.32	3.32
Phosphorus	0.94	0.94	0.94	0.94

ASA = Acetyl salicylic acid; T1 = Diet with 0.00 % ASA; T2 = Diet with 0.025 % ASA; T3 = Diet with 0.050 % ASA; T4 = Diet with 0.075 % ASA

The MRT, ART and ERT for Harco Black and Isa Brown were 41.35 ± 0.03°C versus 41.21 ± 0.03°C, 41.99 ± 0.04°C versus 41.75 ± 0.03°C and 41.65 ± 0.03°C versus 41.60 ± 0.03°C respectively. These values were however within the range of 40.6 – 43.0°C given as the normal temperature range for the domestic chicken (Robertshaw, 2004). There were also significant differences ($p<0.05$) in the evening axillary (EAXT) and evening rectal (ERT) temperatures of birds among the four treatment diets. The general trend was a decrease in the rectal and axillary temperatures with increase in the dietary levels of ASA. The inclusion of ASA in the diets of the experimental birds was able to reduce evening axillary temperature of the birds by 0.26°C (40.85 – 40.59°C) and evening rectal temperature by 0.18°C (41.72 – 41.54°C). These values are approximately 0.3°C and 0.2°C which are values similar to 0.3°C reported by McDaniel and Parker (2004) in their experiment with broiler birds. This study also showed that the rectal temperature was higher than the axillary temperature when taken in the morning, afternoon or evening.

The MRT was approximately 1.05°C higher than the MAXT (41.28 – 40.23°C), ART was 0.85°C higher than AAXT (41.87 – 41.02°C), while ERT was 0.93°C higher than the EAXT (41.63 – 40.70°C). To the best of our knowledge, this is the first of such statistics taken on Harco Black and Isa Brown layers in Nigeria.

The interaction between breed and dietary levels of ASA showed that ASA had the most pronounced antipyretic effect on the evening temperature and the least effect on the morning temperature taken either via the rectal or axillary route. For instance, ASA, decreased the EAXT in HB breed from 40.85°C in T1 to 40.66°Cin T4 (a decrease of 0.19°C), while it decreased EAXT in IB breed from 40.86°C in T1 to 40.52°C in T4 (a decrease of 0.34°C). At the same time, the ERT in HB breed was decreased under the antipyretic effect of ASA from 41.68°C in T1 to 41.59°C in T4 (a decrease of 0.09°C) while it significantly ($p<0.05$) decreased ERT in IB breed from 41.76°C in T1 to 41.50°C in T4 (a decrease of 0.26°C). Hence, the interaction between breeds and dietary levels of ASA showed that the Isa Brown breed had a better

Table 2: Ambient, rectal and axillary temperatures of Isa Brown and Harco Black layers fed varying level of acetyl salicylic acid

Variables	MAT	AAT	EAT	MAXT	AAXT	EAXT	MRT	ART	ERT
					Breed effect of aspirin				
Harco Black	25.50 ± 0.03	31.75 ± 0.03	30.08 ± 0.03	40.30 ± 0.04	41.11 ± 0.04	40.71 ± 0.04	41.35 ± 0.03^{a}	41.99 ± 0.04^{a}	41.65 ± 0.03^{a}
Isa Brown	25.50 ± 0.03	31.75 ± 0.03	30.08 ± 0.03	40.17 ± 0.03	40.93 ± 0.02	40.68 ± 0.04	41.21^{b} ± 0.05	41.75 ± 0.03^{b}	41.60 ± 0.03^{b}
Aspirin levels (%)					**Harco Black**				
0.00	25.50± 0.03	31.75± 0.03	30.08± 0.03	40.31± 0.08^{a}	41.01± 0.03^{b}	40.85± 0.12^{a}	41.36± 0.08^{a}	41.95± 0.06^{a}	41.68± 0.05^{a}
0.025	25.50± 0.03	31.75± 0.03	30.08± 0.03	40.22± 0.07^{b}	41.15± 0.08^{a}	40.75± 0.05^{b}	41.35± 0.06^{a}	41.97± 0.05^{a}	41.73± 0.08^{a}
0.050	25.50± 0.03	31.75± 0.03	30.08± 0.03	40.34± 0.12^{a}	41.16± 0.09^{a}	40.59± 0.07^{d}	41.38± 0.10^{a}	42.04± 0.07^{a}	41.62± 0.11^{b}
0.075	25.50± 0.03	31.75± 0.03	30.08± 0.03	40.32± 0.07^{a}	41.10± 0.06^{a}	40.66± 0.11^{c}	41.32± 0.07^{a}	42.00± 0.13^{a}	41.59± 0.09^{b}
					Isa Brown				
0.00	25.50± 0.03	31.75± 0.03	30.08± 0.03	40.09± 0.09^{d}	41.01± 0.06^{b}	40.86± 0.04^{a}	41.14± 0.07^{c}	41.85± 0.05^{b}	41.76± 0.04^{a}
0.025	25.50± 0.03	31.75± 0.03	30.08± 0.03	40.16± 0.04^{c}	40.83^{c}± 0.07	40.72^{b}± 0.07	41.17^{c}± 0.05	41.65^{d}± 0.07	41.60^{b}± 0.05
0.050	25.50± 0.03	31.75± 0.03	30.08± 0.03	40.19± 0.01^{b}	41.05± 0.01^{a}	40.65± 0.01^{c}	41.23± 0.02^{b}	41.79± 0.02^{b}	41.54± 0.01^{b}
0.075	25.50± 0.03	31.75± 0.03	30.08± 0.03	40.23± 0.06^{b}	40.84± 0.04^{c}	40.52± 0.05^{e}	41.32± 0.06^{a}	41.71± 0.05^{c}	41.50± 0.03^{c}
					Isa Brown + Harco Black				
0.00	25.50± 0.03	31.75± 0.03	30.08± 0.03	40.20± 0.06	41.01± 0.04	40.85± 0.08^{a}	41.25± 0.10	41.90± 0.05	41.72± 0.06^{a}
0.025	25.50± 0.03	31.75± 0.03	30.08± 0.03	40.19± 0.03	40.99± 0.10	40.73± 0.08^{b}	41.26± 0.06	41.81± 0.11	41.67± 0.08^{ab}
0.050	25.50± 0.03	31.75± 0.03	30.08± 0.03	40.26± 0.07	41.10± 0.04	40.62± 0.09^{c}	41.30± 0.05	41.91± 0.11	41.58± 0.05^{ab}
0.075	25.50± 0.03	31.75± 0.03	30.08± 0.03	40.27± 0.09	40.97± 0.07	40.59± 0.03^{c}	41.32± 0.04	41.85± 0.04	41.54± 0.06^{b}

Mean ± Standard error of the mean on the same column with different superscripts are statistically significantly different ($p<0.05$); ASA = Acetyl salicylic acid, MAT = Morning Ambient Temperature; AAT = Afternoon Ambient Temperature; EAT = Evening Ambient Temperature; MAXT = Morning Axillary Temperature; AAXT = Afternoon Axillary Temperature; EAXT = Evening Axillary Temperature; MRT = Morning Rectal Temperature; ART = Afternoon Rectal Temperature; ERT =Evening Rectal Temperature. T1 = 0.00% ASA; T2 = 0.025% ASA; T3 = 0.050% ASA; T4 = 0.075% ASA

tolerance to heat stress and an equally better response to the antipyretic effect of dietary ASA.

The result of the weekly ambient, axillary and rectal temperatures taken over the entire period of the experiment indicated that the ambient temperature for the entire period ranged between 27.44 ± 1.72 and 30.44 ± 2.35^{o}C (Table 3). This showed that the ambient temperature was constantly above the thermo-neutral zone of the birds that normally hovers between 18 – 24^{o}C (Holik, 2009) for birds raised in the tropics. Ambient temperature determines the other body temperatures as they both fluctuate with the ambient temperature (Sottnik, 2002) especially under the prevailing relative humidity. The lowest weekly ambient temperature was recorded in week 1 (27.44 ± 1.72^{o}C), while the highest ambient temperature was recorded in week 6 (30.44 ± 2.35^{o}C). The highest axillary temperature was observed in week 1 (40.84 ± 0.24^{o}C), while the lowest axillary temperature was observed in week 3 (40.50 ± 0.03^{o}C).

Table 3: Comparison between weekly ambient, axillary and rectal temperatures of Isa Brown and Harco Black layers fed varying level of acetylsalicylic acid

Week	Temperature (°C)			Difference
	Ambient	Axillary	Rectal	(Rectal – Axillary)
1	27.44 ± 1.72^{a1}	40.84 ± 0.24^{b}	41.46 ± 0.16^{b}	0.62^{1}
2	28.11 ± 2.11^{a2}	40.58 ± 0.26^{b}	41.71 ±0.14^{b}	1.13^{5}
3	29.11 ± 2.16^{a3}	40.50 ± 0.30^{b}	41.65 ±0.17^{b}	1.15^{5}
4	29.99 ± 1.91^{a3}	40.64 ± 0.27^{b}	41.69 ±0.23^{b}	1.05^{4}
5	29.78 ± 1.66^{a3}	40.71 ± 0.25^{b}	41.62 ±0.19^{b}	0.91^{3}
6	30.44 ± 2.35^{a4}	40.78 ± 0.23^{b}	41.59 ±0.21^{b}	0.81^{2}
7	28.44 ± 1.94^{a2}	40.62 ± 0.17^{b}	41.54 ±0.15^{b}	0.92^{3}
8	29.56 ± 1.63^{a3}	40.55 ± 0.19^{b}	41.46 ±0.12^{b}	0.91^{3}

Means on the same row with the different alphabet superscripts are significantly different at p<0.05. Means on the same column with the different Arabic numeral superscripts are significantly different at p<0.05

Axillary temperature was lower than the rectal temperature and the difference between the two ranged from 0.62°C – 1.15°C (Table 3). The rectal temperature of the birds under the present study was 0.89°C higher than the axillary temperature. The measurement of rectal temperature is therefore a more sensitive method of determining the core body temperature of birds. The axillary temperature is often taken as a measurement of skin as opposed to the core body temperature. Its values thus fluctuate more with the ambient temperature, being lower on cool days when the body is conserving heat and higher on hot days when the body is dissipating heat through the vasodilation of the peripheral blood vessels. That is why rectal thermometry is widely used in veterinary medicine and pediatrics (Sund-Levander *et al.,* 2002).

Conclusion: It can be concluded that the rectal temperature proved a better method of taking the body temperature of the domestic chicken than the axillary temperature. Also, the lower body temperature of the Isa Brown breed in comparison with the Harco Black implied that the former is a better adapted breed to the high environmental temperature that subsists in the tropics. The Isa Brown breed had an equally better response to the antipyretic effect of dietary ASA than the Harco Black breed. This experiment also confirmed the temperature lowering ability of ASA and its potency as an antipyretic drug. Its use as a veritable intervention tool against heat stress in tropical livestock especially in laying chickens should therefore be encouraged.

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